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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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JESUS JUANOS I TIMONEDA
1000 EAGLE GATE TOWER
60 EAST SOUTH TEMPLE
SALT LAKE CITY, UT 84111

EXAMINER

CAO, PHAT X

ART UNIT PAPER NUMBER

2814

DATE MAILED: 02 05 2002

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/293,188

Applicant(s)

Yin et al.

Examiner

Phat X. Cao

Art Unit

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136 (a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on Nov 2, 2001
- 2a) ☐ This action is FINAL. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11; 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1, 2, 7-10, and 15-30 is/are pending in the application.
- 4a) Of the above, claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1, 2, 7-10, and 15-30 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claims _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are objected to by the Examiner.
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. § 119

- 13) ☐ Acknowledgement is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d).
- a) ☐ All b) ☐ Some* c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. _____.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

*See the attached detailed Office action for a list of the certified copies not received.

- 14) ☐ Acknowledgement is made of a claim for domestic priority under 35 U.S.C. § 119(e).

Attachment(s)

- 15) ☒ Notice of References Cited (PTO-892) 18) ☐ Interview Summary (PTO-413) Paper No(s): _____
- 16) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948) 19) ☐ Notice of Informal Patent Application (PTO-152)
- 17) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s): _____ 20) ☐ Other: _____

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DETAILED ACTION

1. The Request for Continued Examination filed 11/2/2001 in Paper No. 12 is acknowledged.
2. The indication of allowability of dependent claims 21-28 are withdrawn because of the new ground of rejection.

Claim Rejections - 35 USC § 112

2. Claims 21-28 and 29-30 are rejected under 35 U.S.C. 112, first paragraph, as containing subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention.

- in dependent claims 21-28 and new independent claims 29-30, the limitation of having "a nitrogen-containing silane adsorbed upon said upper surface" [emphasis added] of an electrically conductive interconnect is not supported in the original disclosure. Specifically, in Applicant's specification (page 17, lines 4-7), Applicant states that the composition of nitrogen-containing silane can be substituted for ammonia during plasma treatment of upper surface 16 of interconnect 12 for forming a passivation layer 32 having a chemical structure of M-N-H (page 10, lines 4-9). However, nowhere in the specification states "a nitrogen-containing silane adsorbed upon said upper surface" [emphasis added] for forming a passivation layer 32 having a chemical structure of M-N-SiH (nitrogen-containing silane).

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3. Claims 21-28 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claims 21-28 are unclear because how can silane (SiH) be considered as ammonia derivative (NH₄)?

Claim Rejections - 35 USC § 102

4. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless --

(e) the invention was described in a patent granted on an application for patent by another filed in the United States before the invention thereof by the applicant for patent, or on an international application by another who has fulfilled the requirements of paragraphs (1), (2), and (4) of section 371© of this title before the invention thereof by the applicant for patent.

5. Claims 1, 9, 17, 19, 21, 24, and 27-30 rejected under 35 U.S.C. 102(e) as being anticipated by Sasaki et al (US. 5,861,675).

With respect to claims 1, 9, 17 and 19, Sasaki, in Figs. 17C-17D and related text, discloses a semiconductor structure comprising: an electrically conductive interconnect 74 disposed within a first oxide layer 69, the electrically conductive interconnect 74 having an upper surface; a passivation layer 75 comprised of a tungsten nitride compound and disposed upon the upper surface, the passivation layer 75 is formed by exposing the surface of the electrically conductive interconnect 74 to plasma in an atmosphere of ammonia (NH₄) and silane (SiH₄) for

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nitriding an area in the vicinity of the surface of the electrically conductive interconnect 74 (see apparatus shown in Fig. 1 and column 13, lines 64-67 through column 14, lines 1-8). Therefore, the passivation layer 75 of tungsten nitride compound would inherently comprise ammonia (NH₄) and its derivatives of nitrogen (N) and hydrogen (H) adsorbed upon the upper surface. It is noted that the first passivation layer comprising tungsten nitride and a second passivation layer comprising ammonia as claimed in claims 17 and 19 do not distinguish from the passivation layer 75 of tungsten nitride comprising ammonia (NH₄) of Sasaki because the passivation layer 75 is produced by the same processes which are used to produce first and second passivation layers as claimed (i.e., exposing the surface of conductive interconnect in an atmosphere of ammonia and silane). Sasaki further disclose an interlayer dielectric 77 disposed upon the dielectric layer 69 and upon the upper surface of conductive interconnect, and the interlayer dielectric being continuously adhered to the upper surface.

With respect to claims 21, 24, and 27-30, Sasaki further discloses a passivation layer comprising a nitrogen-containing silane adsorbed upon the upper surface of the conductive interconnect (column 12, lines 3-10).

Claim Rejections - 35 USC § 103

6. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

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(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

7. Claims 1-2, 7-10, and 15-20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Sekiguchi et al (US. 5,780,908) in view of Hong et al (US. 6,077,774).

Sekiguchi et al disclose in Fig. 3(b) a semiconductor structure comprising: an electrically conductive interconnect disposed within a first dielectric layer 4, the electrically conductive interconnect having an upper surface and including: a titanium/titanium nitride bilayer film 6 disposed within a depression in the first dielectric layer 4; a tungsten film 7 disposed upon the titanium/titanium nitride bilayer film 6 and filling the depression; a passivation layer 7b of tungsten nitride layer, disposed upon the upper surface and having a thickness of less than 50 angstroms (column 16, lines 20-24), the passivation layer 7b formed by exposing the surface of the electrically conductive interconnect 7 to plasma in an atmosphere of ammonia (NH₄) for nitriding an area in the vicinity of the surface of the electrically conductive interconnect 7 (column 15, lines 50-54). Therefore, the passivation layer 7b of tungsten nitride would inherently comprise ammonia (NH₄) and its derivatives of nitrogen (N) and Hydrogen (H) adsorbed upon the upper surface. It is noted that a first passivation layer comprising tungsten nitride and a second passivation layer comprising ammonia as claimed in claims 7, 15, 17, and 19 do not distinguish from the passivation layer 7b of tungsten nitride comprising ammonia (NH₄) of Sekiguchi because the passivation layer 7b is produced by the same processes which are used to produce first and

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second passivation layers as claimed (i.e., exposing the surface of conductive interconnect in an atmosphere of ammonia).

Sekiguchi et al do not disclose an ILD disposed upon the first dielectric layer 4 and being continuously adhered to the upper surface.

However, Hong et al teach in Fig. 1F the obviousness of forming an ILD 36 upon the dielectric layer 12 and continuously adhered to the upper surface of the electrically conductive interconnect 30. Accordingly, it would have been obvious to form an ILD upon the dielectric layer 4 and continuously adhered to the upper surface of the electrically conductive interconnect 7 of Sekiguchi, because the ILD would provide the known purpose of isolating and protecting the electrically conductive interconnect from the outside ambient.

8. Claims 1-2, 7-10, and 15-20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Sekiguchi et al (US. 5,780,908) in view of Liao (US. 6,114,238).

As discussed above, Fig. 3(b) of Sekiguchi et al substantially reads on the above claims, except it does not disclose an ILD disposed upon the first dielectric layer and being continuously adhered to the upper surface of the conductive interconnect.

However, in view of Fig. 1 of Liao, it would have been obvious to form an ILD upon the dielectric layer 4 and continuously adhered to the upper surface of the conductive interconnect 7 of Sekiguchi, because the ILD would provide the known purpose of isolating and protecting the electrically conductive interconnect from the outside ambient.

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Response to Arguments

9. Applicant's arguments with respect to the claimed invention have been considered but are moot in view of the new ground(s) of rejection.

10. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Phat X. Cao whose telephone number is (703) 308-4917. The Examiner can normally be reached on Monday through Thursday. If attempts to reach the Examiner by telephone are unsuccessfully, the Examiner's supervisor, Olik Chaudhuri, can be reached on (703) 306-2794.

Any inquiry of a general nature or relating to the status of this application should be directed to the Group receptionist whose telephone number is (703) 308-0956. Group 2800 fax number is (703) 308-7722 or (703) 308-7724.

PC
February 1, 2002


PHAT X. CAO
PRIMARY EXAMINER